REMARKS

Claims 1, 2, 4-7, 9-12 and 14-21 are pending in this application; and in the Office Action, the Examiner rejected all of these claims over U.S. Patent 6,181,839 (Kannon, et al.). Specifically, Claims 1, 2, 4-7, 9-12, 14, 15, 17, 19 and 21 were rejected under 35 U.S.C. §102 as being fully anticipated by Kannon, et al, and Claims 16, 18 and 20 were rejected under 35 U.S.C. §103 as being unpatentable over Kannon, et al.

Independent Claims 1, 6 and 11 are being amended to better define the subject matters of these claims. For the reasons set forth below, independent Claims 1, 6 and 11, and the dependent Claims 2, 4, 5, 7, 9, 10-12 and 14-21, patentably distinguish over the prior art and are allowable. The Examiner is, accordingly, requested to reconsider and to withdraw the above-identified rejections of Claims 1, 2, 4-7, 9-12 and 14-21, and to allow these claims.

As discussed in greater detail in the present application, this invention relates to methods and apparatus for measuring two-dimensional submicron structures or shapes made via a photolithographic procedure on semiconductor wafers. This is done by determining the edges of those structures or shapes, and these shapes can have many specific forms. Also, the edges of the shapes can extend in various directions, can include curves, and can change directions as the perimeters of the shapes are traversed.

In the present invention, an approximate edge of the shape is first determined, and then, using that approximate edge, a more precise edge is identified. This is done by identifying a point along the approximate edge, obtaining intensity vs. pixel information along a plurality of scans extending in different directions, through substantially the identified point, and in the vicinity of an edge of the image shape.

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Scans with sufficient contrast to contain edge information are recognized, those scans are subjected to an edge detection algorithm, and a point on the more precise edge is detected by using that edge detection algorithm. The obtaining, recognizing, subjecting, and detecting steps are repeated, for different point along the approximate edge, to generate a locus of points that define the more precise edge of the shape.

Kannon, et al. discloses a two-dimensional code reader. With this reader, an area sensor 9 is used to obtain information of L-letter pattern 21. Importantly, Kannon, et al. is dealing exclusively with two-dimensional shapes with straight, line sections (column 2, line 15). The scans are chosen to be in two directions "longitudinal" and "lateral" (up and down, and left to right). The scans are performed several times at different pixels. The disclosed procedure steps in the horizontal and vertical directions by a fixed number of pixels (column 10, line 58) to "optimize memory usage and processing speed."

There are several important general differences between the method and system disclosed in Kannon, et al. and the present invention. For example, Kannon, et al, relates to bar code reading, while the present invention relates to determining shapes of submicron structures formed by photolithography on semiconductor wafers. Another important difference is that the shapes of the bars detected with the Kannon, et al procedure are straight, while the present invention is used to determine shapes that may include curves and change directions.

These general differences between the procedure disclosed in Kannon, et al. and the present invention are reflected in a number of more specific differences. For example, Kannon, et al. uses scans in two directions, while the present invention allows for any

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number of directions (four each in the preferred embodiment) and does not shift a certain number of pixels and obtain another scan.

Furthermore, as described in the Kannon, et al. reference, the same point F in Figure 14 is at the center of the image (not in the vicinity of the edge). Also, with Figure 14, it appears that two edges are being scanned at once, from the fixed point near the center of the image. This is reasonable for two-dimensional bar codes, to which the Kannon, et al invention applies, but the present invention may handle general two-dimensional shapes, even shapes that turn, such as U shapes, shapes with notches, etc. Thus, the present invention makes no attempt to scan more than one edge point per scan, as the present invention steps along an approximation to the edge and performs the multiple scans.

Independent Claims 1, 6 and 11 clearly describe differences between the present invention and Kannon, et al. For example, the preambles of these claims all indicate that the claims are directed to a method or system for extracting two-dimensional image shapes of submicron structures formed by photolithography on semiconductor wafers. Kannon, et al. is not directed to this subject matter.

In addition, Claims 1 and 11 describe the steps of identifying a preliminary, approximate edge of the shape, and then, using points along that approximate edge, identifying a more precise edge of the shape. Claim 6 includes analogous apparatus limitations.

This feature of the present invention is of utility because, as explained in detail in the present application, it helps to achieve excellent results, even when the edge is curved or has a complicated shape.

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The other references of record have been reviewed, and these other references also fail to disclose or suggest the feature of identifying a preliminary, approximate edge, and, using points along that approximate edge, to identify a more precise edge of the shape, as described in Claims 1, 6 and 11.

In view of the above-discussed differences between Claims 1, 6 and 11 and the prior art, and because of the advantages associated with those differences, it cannot be said that any of these claims is anticipated by or obvious in view of that prior art. Consequently, these Claims 1, 6 and 11 patentably distinguish over the prior art and are allowable. Claims 2, 4, 5, 16 and 17 are dependent from, and are allowable with, Claim 1. Likewise, Claims 7, 9, 10, 18 and 19 are dependent from Claim 6 and are allowable therewith; and Claims 12, 14, 15, 20 and 21 are dependent from, and are allowable with, Claim 11. The Examiner is, hence, respectfully requested to reconsider and to withdraw the rejections of Claims 1, 2, 4-7, 9-12 and 14-21, and to allow these claims.

It is believed that this application is in condition for allowance, a notice of which is requested. If the Examiner believes that a telephone conference with Applicants' Attorneys would be advantageous to the disposition of this case, the Examiner is asked to telephone the undersigned.

Respectfully Submitted,

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